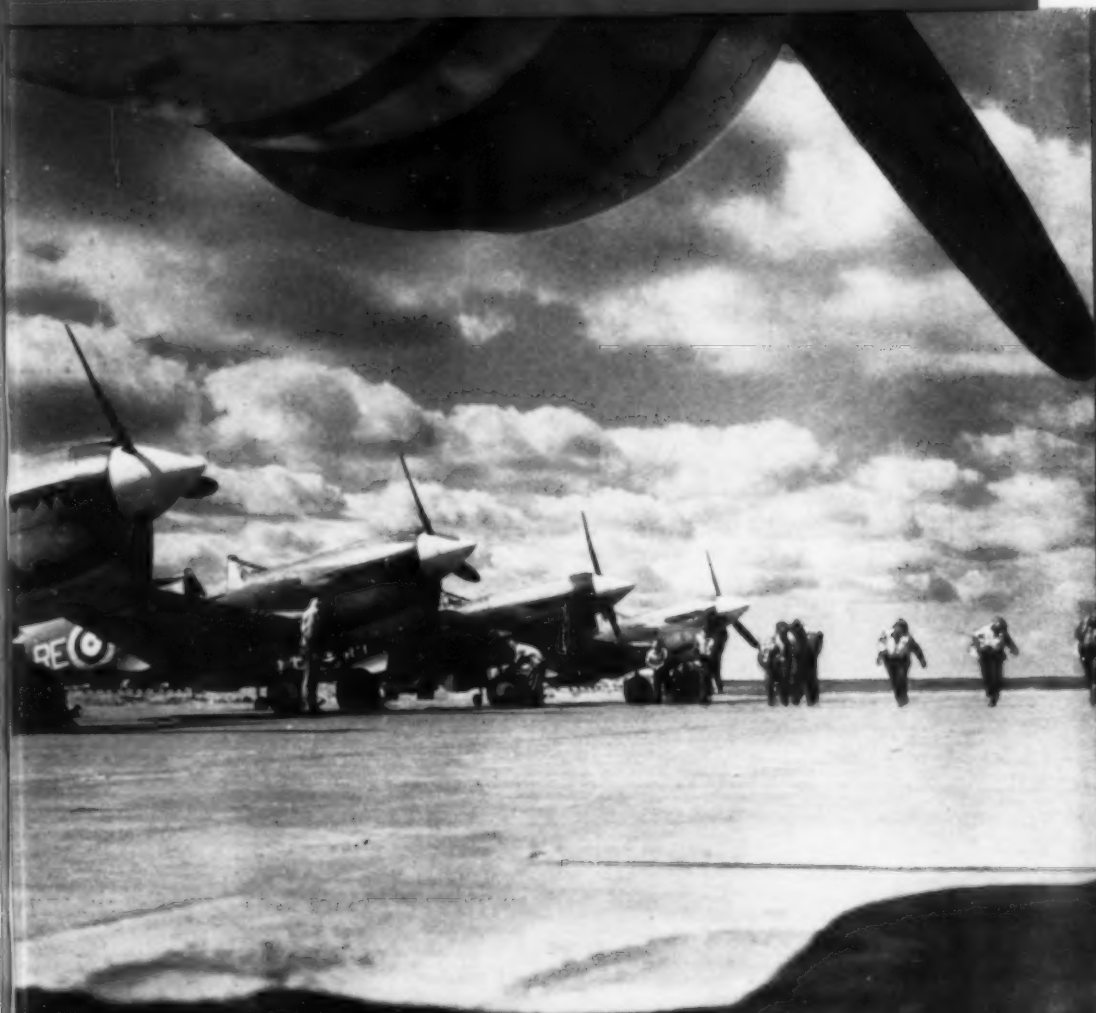


CANADIAN GEOGRAPHICAL JOURNAL

DECEMBER
1942

VOL. XXV
NO. 6



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CANADIAN GEOGRAPHICAL JOURNAL

Published monthly by
The Canadian Geographical Society
at 2151 Ontario St. E., Montreal

Editor - Gordon M. Dallyn

This magazine is dedicated to the interpretation, in authentic and popular form, with extensive illustrations, of geography in its widest sense, first of Canada, then of the rest of the British Commonwealth, and other parts of the world in which Canada has special interest.

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The articles in this Journal are indexed in the *Reader's Guide to Periodical Literature* which may be found in any public library.

The British standard of spelling is adopted substantially as used by the Dominion Government and taught in most Canadian schools, the precise authority being the Oxford Dictionary as edited in 1936.

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Address all communications regarding change of address, non-delivery of Journal, etc., to the publication office, 2151 Ontario Street, East, Montreal, Canada, giving old and new address. On all new memberships, the expiry date will be printed on wrapper containing starting number. This will constitute a receipt for subscription.

Membership in The Canadian Geographical Society is \$3.00 per year in Canada and other parts of the British Empire, which includes delivery of the Journal, postpaid; in United States, Mexico, France, Spain, Central and South America, \$3.50; in other countries, \$4.00. Make membership fee payable at par in Ottawa.

Member Audit Bureau of Circulations.

Special Representatives:

Ontario: F. A. Dallyn, 21 King Street, E., Toronto, (Tel. EL. 2863)
Quebec: F. A. Dallyn, 2151 Ontario Street E., Montreal. (Tel. FR. 1722)
Europe: Norah C. Perry, 5 Upper Dagnall Street, St. Albans, Herts., England

Entered as second-class matter at the Post Office Montreal, Canada.

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An R.C.A.F. "team" studies its course to Germany just before the take-off.

R.C.A.F. OVERSEAS

by Flight Lieut. BASIL DEAN, R.C.A.F.

NOT long ago, Air Marshal Harold Edwards, Air Officer Commanding-in-Chief, R.C.A.F. Overseas, issued his first official communique concerning the activities of the squadrons under his command. It was written in the best communique style — terse, accurate, matter-of-fact. Its arrival in the offices of London's Fleet Street newspapers caused something of a commotion. Blasé air correspondents began to call R.C.A.F. headquarters in London to

ask whether this was the first time that R.C.A.F. squadrons had been in action. Others wanted to know whether it marked a turning point in the history of the R.C.A.F.

Of course, it was neither. That first communique appeared almost exactly two years after the first R.C.A.F. squadron went into action in Britain. It is too often forgotten that a squadron of the Royal Canadian Air Force fought with great

The setting sun silhouettes the "office" of a Royal Canadian Air Force bomb aimer in a Coastal Command Hudson.

distinction in the Battle of Britain. This has nothing to do with the so-called "All-Canadian" squadron of the Royal Air Force which, led by the legless Squadron Leader Douglas Bader (now a wing-commander and a prisoner of war), also established a magnificent record. The R.C.A.F. squadron which fought then was Canada's No. 1 Fighter Squadron, which had reached England just as France was falling. It is still flying with Fighter Command, and is under command of Squadron Leader Keith Hodson, D.F.C., of London, Ontario. To such famed Canadian names as Deane Nesbitt and Ernie McNab have been added new ones from the generation of flyers who have been trained under the British Commonwealth Air Training Plan — "Jeep" Neal, Ian Ormston, Don Morrison and many others.

If the first R.C.A.F. communique was a turning point at all, it simply indicated that the Royal Canadian Air Force overseas had reached a point in its development where its activities justified a communique of its own. It indicated that about 25 R.C.A.F. squadrons, commanded and staffed by Canadians, were flying, not only in Britain, but in the Middle East and the Far East. For eighteen months, bomber squadrons of the R.C.A.F. had been taking part in the great night-offensive against Germany; for almost a year, the "Demon" squadron of Coastal Command, a Lockheed Hudson squadron of the R.C.A.F., had been ravaging German shipping off the Dutch Coast with brilliant success; for two years, R.C.A.F. fighter squadrons had been in key positions



in Fighter Command; and for well over two years, R.C.A.F. army co-operation flyers had been waiting with growing impatience for real action. (They got their wish on August 19, when the Canadian Army went into Dieppe.)

Shortly before that first communique was issued, Major the Hon. C. G. Power had announced that the R.C.A.F. would soon have its own bomber group and its own fighter stations in Britain, and these are now in process of formation. This did



not indicate that there was to be any separate operational direction for the R.C.A.F. (Both Air Marshal Edwards and Major Power have repeatedly made it plain that they well recognize the need for single operational control), but it *did* indicate, very significantly, the extent and dimensions which the overseas force of the R.C.A.F. had now reached. To man and staff a bomber group calls for many thousands of men; to man and staff a fighter station calls for many more hundreds of men.

Thus, after less than two and a half years' operation, the British Commonwealth Air Training Plan had developed into a scheme with a double purpose. It was training enough pilots, observers and air gunners, as well as ground crews, to man an exceptionally large striking force of the R.C.A.F. in Great Britain — Canadian-manned from top to bottom; and it was, in addition, continuing to train thousands of air crew for the R.A.F. and the air forces of the other Dominions.





Top left:—A "Demon" takes off. Bottom left:—"To Hitler — without regards"
 At top:—The moment a bomber returns from a raid its engines are checked by ground crew.
 Above:—Ground crew. They work night and day to keep bombers bombing. They, too, are part of the "team"



Eastbound for Germany is this Halifax bomber.

Of the total production of the Air Training Plan, more than 60 per cent and (in the earlier stages) up to 80 per cent have been members of the Royal Canadian Air Force, and of these, only a portion have gone into R.C.A.F. squadrons.

It may be that in Canada people have got so used to the idea of the training plan, with its enormous stations dotted about all across the Dominion, that it no longer occurs to them that this plan is one of the miracles of the present war. Truly speaking, you have to cross the Atlantic and see the finished products of the plan in action against the enemy; you have to travel around the aerodromes of Britain—and there are hundreds of them—and see

the number of Canadians that can be found on every station you visit; not only on stations where there are Canadian squadrons, but on all of them. Then you can get some idea of the size of the task which Canada undertook early in 1940.

In every big show the R.A.F. has staged for the last year and more, there have been Canadians taking part. Canadian fighter, bomber and coastal squadrons joined in the attacks on the *Scharnhorst* and *Gneisenau* as they fled up the Channel and into the Baltic last winter. In each of the 1,000 bomber raids on Germany during the summer, over 1,000 Canadians were included in the bombing "teams".

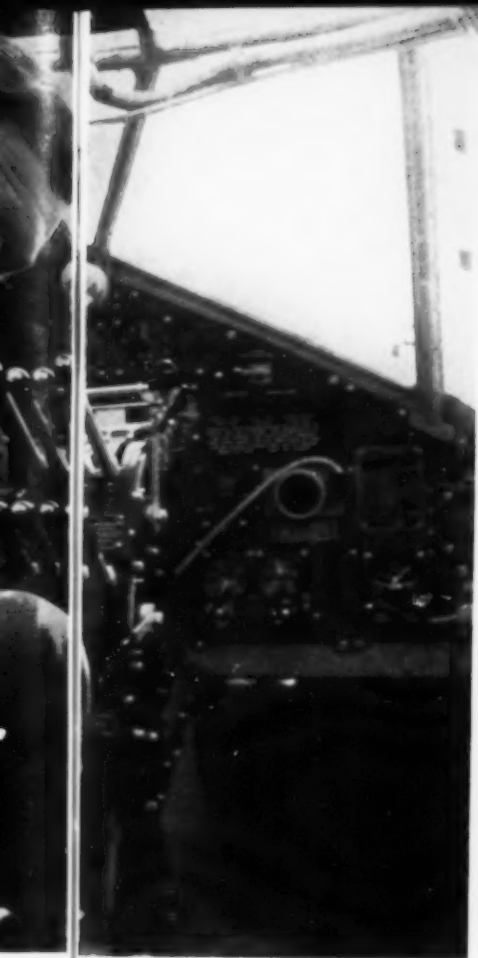
In every daylight sweep that Fighter

Right:—"That men may fly." Women's division goes to Britain.





These are the men who bomb Germany. Sometimes they fly with Royal Canadian Air Force squadrons: sometimes they fly with the R.A.F. Night after night they carry destruction to the German war machine, to German cities and towns. Here they are at their jobs.



Top centre: — "Everybody o.k.?" the Captain of the aircraft checks up before the take-off. Top left: — The radio operator is also qualified to man a gun. Bottom left: — The bomb aimer crawls into his "office" in the nose of the aircraft. Top right: — Down goes a flare to light the target. Lower right: — The gunner "blocks interference".





Top left:—Blenheim fighter pilot
Above:—Catalina take-off
Bottom centre:—Fighter lads

Top centre:—An air-gunner from Manitoba sits behind the vicious twin guns in the mid-upper turret of a Hampden bomber.

Command and Bomber Command have jointly staged this summer over Northern France, usually two or more R.C.A.F. Spitfire squadrons have taken part and other Canadians have flown the Boston bombers which have regularly gone along. An R.C.A.F. torpedo bomber squadron has

joined the "Demons" in their attacks on German shipping creeping up the shores of Holland. And toward the end of the summer it was announced that an R.C.A.F. flying boat squadron had been formed. Another flying boat squadron, which had been in operation for several months



Top right:—The rear-gunner in a Wellington bomber does not seem concerned about the job that lies ahead. His four guns keep Nazi fighters at their distance.

Above:—Squadron Leader "Bob" Morrow, D.F.C., of Toronto carries the Maple Leaf into the fight.

was already in Ceylon, where its deeds had won it world-wide fame. One of the R.C.A.F. Spitfire squadrons was serving in the Middle East against Rommel's Afrika Korps.

And in addition to these there were the thousands of members of the R.C.A.F.

flying with R.A.F. squadrons in every theatre of war. At the time of that first communique there were upwards of 2,000 Canadians in the Middle East, and in Ceylon R.C.A.F. members of an R.A.F. Hurricane squadron had accounted for at least seven Jap aircraft.



A "Wimpy's" "team" returns from another smashing attack on German industry.



In the "watch room" of a bomber station a Royal Canadian Air Force bomber "team" checks the course before the take-off.

Bottom right:—Air Minister Power, on a visit overseas, chats with two fighter aces — Flight Lt. (now Squadron Leader) Norman Bretz, D.F.C. (left), and Squadron Leader "Bob" Morrow, D.F.C., both of Toronto.



The moment a Spitfire lands after a brush with the enemy its deadly guns are re-armed, ready for the next job.





Thousands of members of the Royal Canadian Air Force are included in the "teams" which man Britain's mightiest bombers. Here the stern and impressive nose of a giant Halifax is silhouetted against the evening sky just before its R.C.A.F. crew takes a load of tons of bombs winging over Germany.

Off into the night to deliver another blow for victory. This R.C.A.F. bomber "team" mans its aircraft for another raid. Not only in the R.C.A.F. squadrons but throughout the hundreds of R.A.F. squadrons wherever they are meeting the enemy, there are Canadians trained under the great British Commonwealth Air Training Plan.





In most of Britain's biggest bomber raids on Germany and German-occupied territory, an average of about a fifth of the personnel have been members of the Royal Canadian Air Force. In the great 1,000-bomber raids more than 1,000 Canadians took part on each occasion. From the farms and factories, the high schools and the universities of Canada, from every walk of life, young Canadians have gone forth to add lustre to the wings of the R.C.A.F., and to write more glorious pages into the history of the Dominion. Canadians fly big Halifax bombers like the one pictured above at a dispersal point waiting for its crew. The lad at the left, weighted down with his flying kit, is from Fredericton, N.B., the navigator of a Halifax crew. He is typical of the thousands of young Canadians trained under the B.C.A.T.P.



Lads like those above — the "team" of a Royal Canadian Air Force Halifax — are daily carrying the offensive to the Germans. Some of them left school or college to enlist in the Air Force. Many of them are barely out of their 'teens. But they are seasoned veterans of aerial warfare. Light-heartedly, but none the less in dead seriousness, they are blasting day after day at the nerve centres of the enemy. Loath to tell the stories of their exploits their favourite description of a raid is — "It was just a piece of cake". But citations accompanying the awards for gallantry which many of them have won tell an amazing story of skill and daring and high courage. On the right a bomb aimer from Stratford, Ontario, climbs into the cockpit from his "office" in the nose of the giant Halifax. It is from this "office" that he directs the course of the tons of bombs which he sends hurtling down on the enemy.

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Yes, long before that first communique was issued, the R.C.A.F. overseas had grown to manhood. Its achievements had already been terrific — all the more so, considering that the R.C.A.F. in Canada before the war had an establishment of about 4,000 and an actual strength of no more than 2,500 in all ranks. Months before the communique appeared, the 100,000 mark had been passed (although the proportion of these who were serving overseas was a secret, it was known to be very large), and it is safe to assume that by this fall that figure of 100,000 has been left far behind.

The Canadians who have taken part in the fierce and almost ceaseless air fighting of the last year have, without exception, fought with a gallantry and devotion which measures well alongside the exploits of

those Canadians of a former generation who served in the R.F.C., the R.N.A.S. and the R.A.F. of the last war. At the time this article was being written, Air Marshal W. A. Bishop, V.C., — he is still "Billy" Bishop to every Canadian flyer — was visiting the lads who are now carrying the torch which he bore so nobly in company with Collishaw, Barker, McLeod and others a generation ago. So far in this war, there are no Canadians who wear a string of decorations to compare with his V.C., D.S.O. & Bar, M.C., D.F.C., Legion d'Honneur and Croix de Guerre with two palms. But many of them have been decorated for their exceptional exploits.

At the beginning of October, Canadians in the air forces had been awarded four D.S.O.'s, one of which went to Wing Commander John Fulton, of Kamloops,



He used to be a clerk in an insurance office in Midland, Ontario. Now he is the pilot of a Halifax bomber, veteran of many raids over Germany. His skill is further evidence of the quality of the training provided by the British Commonwealth Air Training Plan, and his courage is further tribute to the quality of men that the cities and towns and prairies of Canada produce. On the opposite page is a typical fighter pilot standing on the wing of a Hurricane. The scarf at his throat is characteristic dress for fighter pilots. He is a warrant officer second class. Not all pilots nor all aircrew in the R.C.A.F. are commissioned officers, but to these fighting comrades of the skies, such distinctions are unimportant.





Well pleased with what they saw in Britain were Canada's Air Minister and the Chief of the Air Staff when they made a tour of inspection of R.C.A.F. units overseas. Here they talk with the R.C.A.F. commander overseas and the Canadian High Commissioner. Left to right:—Air Marshal Harold Edwards, Air Officer Commanding-in-Chief, R.C.A.F. overseas; Major the Hon. C. G. Power, M.C., Minister of National Defence for Air; Rt. Hon. Vincent Massey, Canadian High Commissioner in London, and Air Marshal L. S. Breadner, D.S.C., Chief of the Air Staff.

British Columbia, who already held the D.F.C. and the A.F.C., and who was reported missing a few days before the award was announced. In addition to these, there had been 202 awards of the D.F.C., 14 of the Bar to the D.F.C., 26 of the A.F.C., 76 of the D.F.M., one Bar to the D.F.M. and six of the A.F.M. Furthermore, there had been one C.B., three G.M.'s, three M.B.E.'s, three O.B.E.'s, and 30 Canadians had been mentioned in despatches.

During the month of September alone, in fact, 37 Canadians were awarded the D.F.C., 12 won the D.F.M. and three were given Bars for the D.F.C.'s they had already gained. Included among these were many awards for conspicuous gallantry shown during the intense air battles which raged over Dieppe on August 19 and in which Spitfire and Mustang squadrons of the R.C.A.F. performed so excellently. It has been reported that a signal was sent by the army at Dieppe while the operation

Top right:—"Bundle of grief" is prepared for the Nazis. These armourers will load this sensitive "egg" under the wing of the Hurri-bomber behind.

Bottom right:—"Three musketeers of the sky." All of them have won the Distinguished Flying Cross as fighter pilots. Left to right:—Flt. Lt. Ian Ormston, Montreal; Flt. Lt. "Jeep" Neal of Quebec City, and Pilot Officer Don Blakeslee, Fairport Harbour, Ohio.



"Wimpy" is what members of the R.C.A.F. bomber "teams" have dubbed these Wellington bombers. Canadians have won great distinction flying these aircraft against the enemy. This picture was "shot" somewhere in Britain just before the Wimpy's R.C.A.F. crew went winging toward Germany.

was in progress that the air support was "faultless". In this tribute, the Canadian squadrons, each of which made several sweeps over the area during the day, may proudly take their full share.

The story of that day has been fully told many times over — how the Spitfires battled ceaselessly throughout the day to keep the bombers and the low-flying fighters of the Luftwaffe from getting at our troops on the ground. They fought with an even greater fury that day because they knew that their brothers-in-arms of the Canadian Army were fighting there below on the beaches. They fought with a fury and a determination which were born of their intense conviction that this was a day of days — that they must not let the army down.

Dieppe for the fighter squadrons, the 1,000 bomber raids and other offensive operations of lesser magnitude (but still on a terrifying scale) for the bomber squadrons — these formed the culmination of the first two years' work of the R.C.A.F. and of the thousands of officers and men who administer the British Commonwealth Air Training Plan. But even these were not the climax; or, at any rate, the men who fly do not regard them by any means as the climax. For them, these big shows were just a measure of what the Royal Canadian Air Force can and will achieve when the big opportunity arrives



for them with the opening of the second front.

They do not think it is going to be easy, for these boys live in no fools' paradise. They know what they are facing; and they face it, none the less, with pride and fierce courage. When the day comes for them to embark on even more intense and desperate



endeavour, they will take it in their stride. Those long hours of ground instruction; their first nervous solo flights in Tiger Moths, their growing confidence in their ability to fly as they graduated to Ansons, Cessnas and Harvards; their work at operational training units — all these will serve to strengthen their spirit and their courage against the testing day.

In what they have already attempted they have not failed.

Over Berlin and Benghazi, over Colombo and Cologne, over Trieste and Tobruk, over Dusseldorf and Dieppe, they have been tried and tempered.

They have not failed; they will not fail hereafter.



Wherever the R.A.F. battles the enemy there too will be found Canadians — members of the Royal Canadian Air Force. In addition to one full R.C.A.F. Catalina Flying Boat squadron in Ceylon, there are hundreds of Canadians in the R.A.F. squadrons defending the island. Pictured here is one of the "Cats" which the Canadians fly.

"Birchall saved Ceylon." That's what they will tell you in Ceylon about Squadron Leader L. J. Birchall of St. Catharines, Ontario. Pictured seventh from the left in the back row of these Canadians serving in Ceylon, he is the man who, patrolling far out to sea, flashed the first word of a Jap invasion threat. He never was heard from again, but the defenders of Ceylon were warned in time to repulse the raiders.





Canadians played their part, too, in the great victory of the Western Desert. In the Middle East there is one Royal Canadian Air Force fighter squadron, but, as well, there are more than 2,000 Canadians attached to R.A.F. squadrons. They have all contributed their share toward Rommel's defeat. The pictures on these pages were made just before the start of the big British "push", when Rommel's supply lines and rearward bases were being constantly harassed from the air. The lads with the camel are Canadians who compose the crew of the B-25 American-built bomber in the background. In the centre a flight lieutenant from the Maritimes borrows a "jeep" to get to his airfield. The two R.C.A.F. pilot officers on the right "bless" the sand and the heat, but they have done a good job on the Afrika Korps. Below, the Spitfires of a Canadian squadron kick up the desert dust as they prepare for another blow at Rommel.







An aircraft is mundane to these seasoned veterans of the R.C.A.F. in Ceylon, but a rickshaw is "romantic".

Ready for instant action at first sight of the Jap is Sgt. C. L. Nuttbrown of Sherbrooke, Quebec, R.C.A.F. fighter pilot in Ceylon.

Pilot Officer Jimmy Whalen of Vancouver was a law student at the University of British Columbia. Now, in Ceylon, he has three Jap navy bombers to his credit.



R.C.A.F. fighter pilots in Ceylon have proven themselves able to handle the best the Jap can send. The two pilot officers on the right display the proof of their efficiency — the tail assembly of a Jap zero in whose destruction they shared. Below: — Far out to sea from Ceylon members of a Royal Canadian Air Force Catalina squadron patrol in search of the Japs. This sergeant air-gunner stands his watch in the gun-blister.





7 Days with the R.C.A.F.

Typical. communique from London, England

"DURING THE WEEK ENDING NOON, THURSDAY, OCTOBER 22, 1942, SQUADRONS OF THE ROYAL CANADIAN AIR FORCE STATIONED IN GREAT BRITAIN ENGAGED IN THE FOLLOWING OPERATIONS:

"A NUMBER OF CANADIAN FIGHTER SQUADRONS FORMED PART OF THE SUPPORTING FORCE TO BOSTONS OF BOMBER COMMAND IN A DAYLIGHT ATTACK ON THE DOCKS AT LE HAVRE. NO ENEMY FIGHTERS WERE ENCOUNTERED. LATER IN THE WEEK UNDER REVIEW THEY TOOK PART IN COVERING OPERATIONS WHEN UNITED STATES ARMY AIR FORCE FLYING FORTRESSES BOMBED THE ENEMY'S IMPORTANT SUBMARINE BASE AT L'ORIENT AND WALPERTUS AERODROME NEAR CHERBOURG. IN THE COURSE OF DAYLIGHT SORTIES OVER ENEMY OCCUPIED TERRITORY R.C.A.F. FIGHTERS ATTACKED RAILWAY TARGETS IN NORTHERN FRANCE NEAR FECAMP. OUR PILOTS, USING THEIR CANNON WITH TELLING EFFECT, DAMAGED A RAILWAY SIGNAL BOX, BLEW UP A LOCOMOTIVE AND SHOT A FLAK TOWER TO PIECES. ENEMY TROOPS WERE ALSO STRAFED IN THE ETRETAT AREA. TWO HEAVY FREIGHT TRAINS WERE ATTACKED AND THEIR LOCOMOTIVES PUT OUT OF COMMISSION. A FOURTH LOCOMOTIVE IN THE VICINITY OF DOULDEVILLE WAS ALSO DAMAGED AS WAS A FLAK TOWER IN THE SAME AREA. AN ANTI-AIRCRAFT GUN POST NEAR CRIEL WAS ALSO HIT.

"THROUGHOUT THE WEEK NUMEROUS OFFENSIVE AND DEFENSIVE PATROLS WERE FLOWN IN DAYLIGHT BY R.C.A.F. SQUADRONS OF FIGHTER COMMAND AND DURING THE HOURS OF DARKNESS INTRUDER OPERATIONS WERE CARRIED OUT OVER AERODROMES IN ENEMY OCCUPIED TERRITORY.

"LAST WEDNESDAY NIGHT SEVERAL R.C.A.F. SQUADRONS, ONE OF WHICH WAS FRENCH-CANADIAN, TOOK PART IN BOMBER COMMAND'S RAID ON COLOGNE AND OTHER INDUSTRIAL OBJECTIVES IN THE RHINELAND. SOME OF OUR BOMBERS HAD TO CONTEND WITH INTENSELY HEAVY FLAK AND SEARCHLIGHT ACTIVITY AND SOME ENCOUNTERED ENEMY NIGHT FIGHTERS, BUT THEY REACHED AND BOMBED THEIR TARGETS WHERE FIRES COULD BE SEEN FOR MANY MILES. COLOGNE IS THE THIRD LARGEST CITY IN GERMANY, AND, APART FROM ITS GREAT INDUSTRIAL IMPORTANCE, IS ONE OF THE ENEMY'S BIGGEST TRANSPORT CENTRES.

"DURING THE WEEK CANADIAN COASTAL COMMAND SQUADRONS ENGAGED IN ANTI-SUBMARINE PATROLS AND CONVOY AND ESCORT DUTIES.

"ALTHOUGH R.C.A.F. SQUADRONS WERE NOT INVOLVED, MANY CANADIANS WERE NUMBERED AMONG THE CREWS OF THE LANCASTERS WHICH CARRIED OUT BOMBER COMMAND'S HEAVIEST DAYLIGHT RAID OF THE WAR. THIS WAS THE SPECTACULAR AND SUCCESSFUL ATTACK ON THE GREAT SCHNEIDER ARMAMENT WORKS AT LE CREUSOT AND ON THE TRANSFORMER STATION WHICH SUPPLIES IT WITH POWER. LE CREUSOT IS LOCATED 170 MILES SOUTH-EAST OF PARIS, JUST WITHIN THE BOUNDARY OF OCCUPIED FRANCE. THE SCHNEIDER-CREUSOT PLANT IS THE LARGEST AND MOST IMPORTANT OF ALL THE ARMAMENT FACTORIES OF THE INTERNATIONAL SCHNEIDER CARTEL. IT HAS BEEN TURNING OUT VAST QUANTITIES OF HEAVY GUNS AND OTHER IMPORTANT WAR MATERIALS FOR THE ENEMY. A GREAT WEIGHT OF BOMBS WAS DROPPED DURING THE ATTACK, WHICH WAS PRESSED HOME WITH GREAT DETERMINATION AND WAS CONCENTRATED INTO LESS THAN SEVEN MINUTES."

Top left:—First leg of the trip to Germany. Bomber crews climb into transport which takes them to dispersal points.
Bottom left:—Such "teams" as these are bombing German targets consistently and precisely.



FIRE CANOE

(Illustration by the author)

From wind-swept crested headland, from fire-swept hillside gray;
Across the beds of tufted rice that fringe the quiet bay,
From leafy copse and thicket where dappled shadows lie,
A thousand eyes are watching as the Fire Canoe goes by;
And Wood Folk* pause in silent awe as up the winding stream
Comes the deep sigh of labouring breath,—the labouring breath of steam!

O voices of the Northland! O Northland's symphonies!
Drowsy breeze and screaming gale and crash of crumbling seas,
Whir of wings thro morning mists . . . geese gabbling on the bars,
And booming call of lonely owl under the glittering stars;
Bugle call of restless moose . . . wolves baying to the moon . . .
And gentle lap of water, when the long day is done;
But now new echoes waken thro age-old solitudes . . .
Sombre before a flickering fire a trail-worn native broods!

* * *

There are ghosts on northern lake and stream . . . when night mists settle down,
Ghosts on portage and lonely trail . . . ghosts of the men long gone,
For coiled are galling tracking-lines and paddles and poles laid away,
Only brave memories cherish — brave men of a vanished day;
Thro sun and storm they kept the faith in lands where the gray goose flew,
Till their songs were drowned by steam's harsh voice,—the voice of the Fire Canoe!

S. C. ELLS

*The term Wood Folk refers to the (so-called) wild animals of the northern woods.

(NOTE:—During the second half of the nineteenth century, stern wheel steamers,—originally referred to by Breed and Indian as 'fire canoes',—replaced York boats and freighting canoes on many rivers of Northern Canada. In the name of Progress, a race of unrivalled rivermen—rugged individualists all, who took a deep pride in their skill and prowess—was exchanged for a few tons of engines. The hoarse and toneless voice of the steam whistle, drowned forever the haunting melodies and soul-stirring chansons of hardy voyageurs.—S.C.E.)

THE MOTOR CAR INDUSTRY MAKES



Vehicles? Yes, they are still produced by automotive companies, but they take on new shapes. This is one of the light armoured reconnaissance cars being produced in some quantity at Oshawa.

VICTORY ITS BUSINESS

(General Motors taken as example)

by T. R. ELLIOTT

THE most powerful secret weapon so far brought to light by the war was found in the possession of the automotive industry. It was not a death ray or a lethal projectile of any kind, but rather a technique — the technique of "mass precision". It has now been shared, or is being shared, to the fullest extent with every branch of industry building the tools of war. It may well win the war.

Manufacture by the system of interchangeable parts — which is the broad application of mass precision — is not new. It is as old as most of us. But the courage and imagination required to apply this technique to unfamiliar problems is both new and rare. That is where the automotive industry has excelled.

Many in the industry can remember the day, thirty-five years ago, when three Cadillac cars arrived in England for an unheard-of demonstration — not a test of performance, but an official proof of precision manufacture. The three cars were completely torn down, the parts piled together and stirred like a salad. Then, before the bulging eyes of the members of the Royal Automobile Society, mechanics drew out part after part and assembled three complete Cadillacs which not only looked right, but which performed triumphantly in a stiff 500-mile test.

That was the start. The idea was developed and improved as machine tools and instruments improved. In World War I, it was applied to guns and shells and tanks; with what result may be calculated from the remarks of a German field marshal after it was all over, who, in referring to the industrial output of North America said, ruefully, "They understood war".

This was a tribute to industrialists and skilled workmen but, more than that, it was a tribute to the "secret weapon" — the technique in which the automotive industry





Before the trickle becomes a stream. Tool room of the North Plant of General Motors, Oshawa, shown here, is typical of shops where mass production on new problems is planned.

leads all others. Three years ago, this technique was eagerly examined by British authorities when the crisis came. These authorities had no conception of the extent to which this single industry could be a factor in war, but they and all the leaders of the United Nations have been considerably enlightened since that time.

War Clouds

In 1938, with what everybody thought were the usual war clouds gathered in the Balkans, William S. Knudsen was visiting Toronto on business. Newsmen cornered him to ask: "In the event of war, will the automobile industry make munitions?" Modestly Mr. Knudsen replied: "I can only say that ours would be an appropriate industry to which the job of war production might be assigned, because we have the plants, the skills and the tools." The

sinews of war, to the value of billions of dollars per year, which are now rolling from automotive assembly lines in the United States, are a tribute to the "appropriateness" of mass precision in time of war.

In Canada, the skill and imagination of the automotive industry were enlisted tentatively even before the Nazi invasion of Poland. "What", Britain asked, "could Canada provide in the way of motor transport in the event of hostilities? Here are the blue-prints and specifications. What can be expected in rate of production?" That was the way it began. It was a bow, of course, in the direction of the secret weapon, without any one's fully realizing what weight of responsibility would eventually have to be placed on Canada's motor-car companies. Gradually, it became clear that the automotive industry in Canada was destined to take on a heavy

THE MOTOR CAR INDUSTRY MAKES VICTORY ITS BUSINESS

load, and that load has since been assumed with startlingly gratifying results.

Mass Production for War

There is no mystery about it. Take the technique of mass production apart and it will be found to rest upon a number of distinct components. These are: quality and precision; skill in retooling for new mass production assignments; the imagination of technical management and the ability to switch from competitive practice to full co-operation; ability to use the minor but important skills of hundreds of sub-contractors; ability to cut costs as much as 50 per cent as production proceeds (second nature ingrained by the world's most competitive peace-time business); and the ingenuity to stretch machine-tool capacity to the limit. Without expanding on these components of a single industry's efficiency, let us look at results.

First regarded in Canada as a source for military vehicles, the Canadian automotive industry is now producing, or making ready to produce, an amazing variety of tools of war. A partial list includes:

Armoured vehicles — reconnaissance and scout cars

Transport vehicles — ranging from 8 cwt. to 3 tons

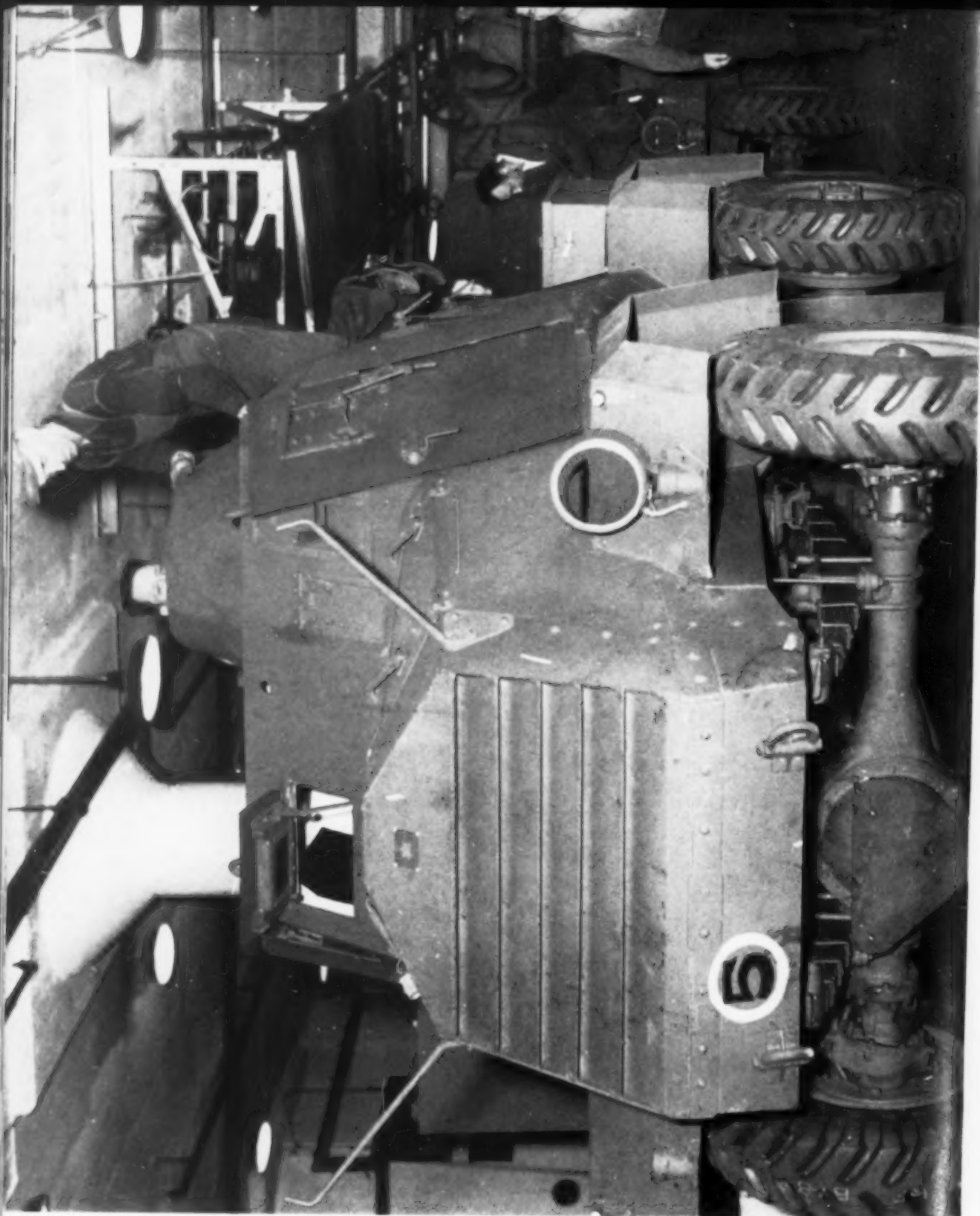
Service vehicles, — such as water purification plants, laundries, field work-shops, power generating outfits, dental clinics, medical stations, ambulances, etc.

Universal carriers	Aircraft fuselages
Browning machine guns	Aircraft components
Fuses	Gun parts
Tank components	Gun sights
Machine tools	Fire control instruments
Naval gun mountings	Shells
Shell components	Anti-tank gun carriages

Thus it will be seen that the automotive industry is in production on equipment for the essential groups: tanks, guns, shells, planes. No single motor-car factory produces all the items in this extensive list, but a typical automobile company will be found to cover a wide section of the total. More than half of the war products named above are being produced in quantity by the various General Motors factories in Canada. Even if vehicles are taken for granted, this still leaves a wide variety of war products emanating from what, in the public mind, is regarded as an automobile company.

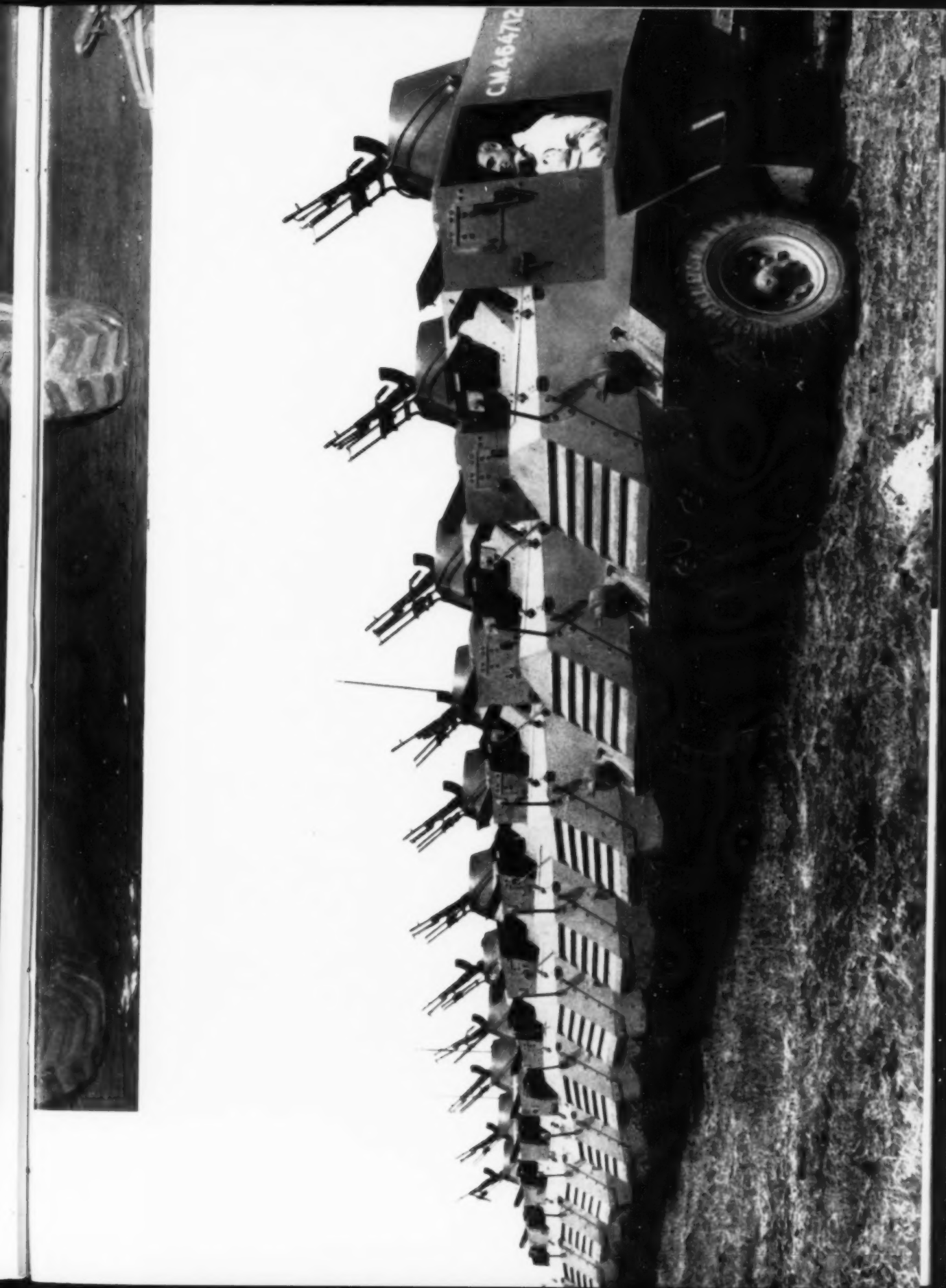
In the planning stage, machine shops do the try-out work. This is the machine shop of the North Plant tool room.

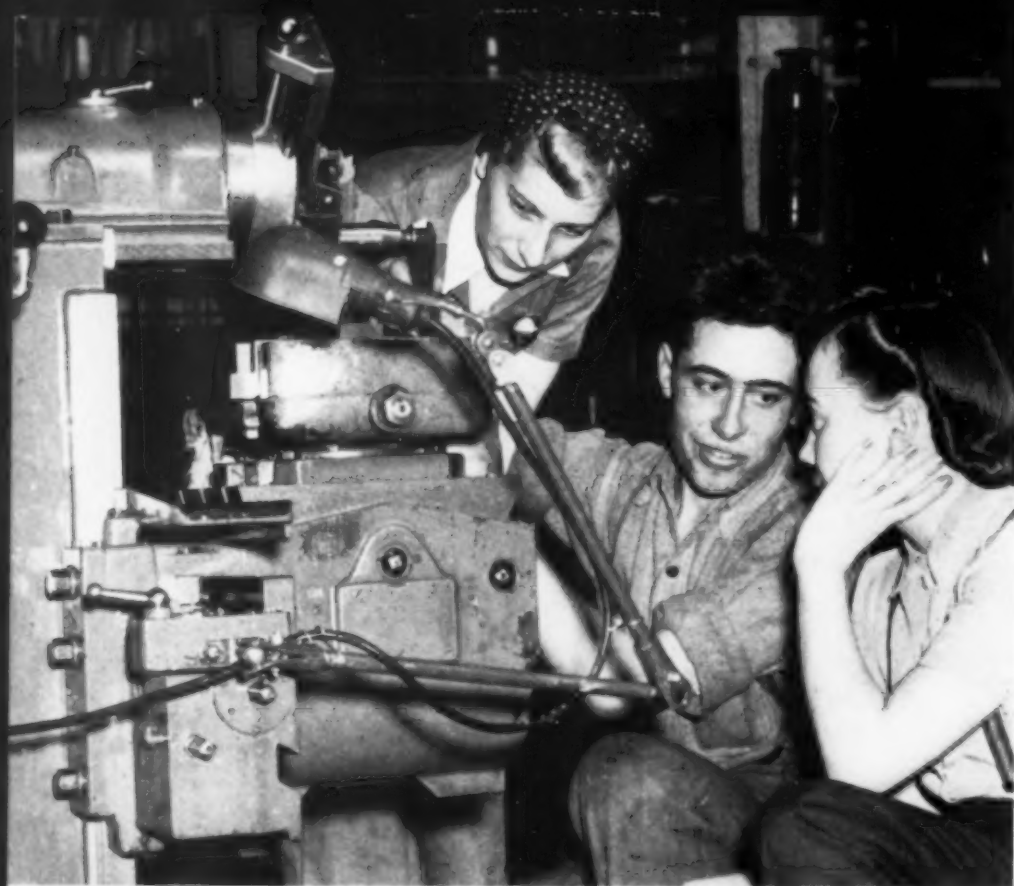




Light reconnaissance car on the assembly line, nearly ready for driving test

Below:—Column of light reconnaissance cars at a Canadian training camp — Bren guns are mounted after they leave the General Motors factory.

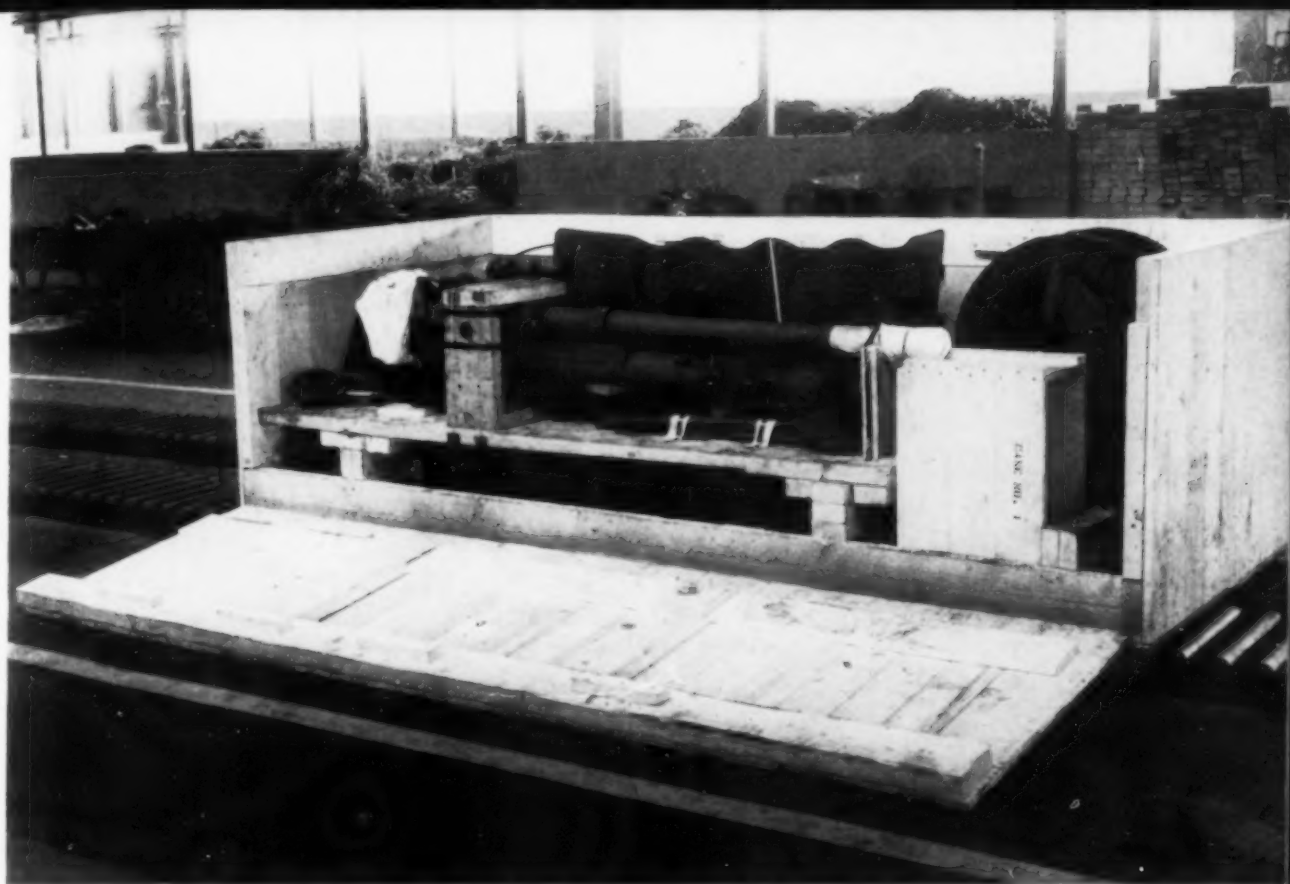




Two girls from the prairies are taught to operate a shaper by an experienced machinist at Regina Industries (General Motors).

Below:— The finished product of Regina Industries Limited — carriage for a six-pounder anti-tank gun with gun mounted.





Another type of anti-tank gun, knocked down for shipment to a distant fighting front. Carriages made at Regina Industries.

Reverting to the components of the "mass precision" technique, the output of General Motors in Canada might be examined for evidence that the industry really has a special appropriateness in war-time production. Take the case of a western assembly factory of General Motors of Canada, Limited, where cars and trucks were built or assembled up to 1941 — "Western made for Western Trade".

Conversion to War Needs

Complete conversion of the Regina factory to war production, in a remarkably short time, may be cited as an example of the automotive industry's versatility in the all-important task of "change-over". The decision to convert, for manufacture of carriages for anti-tank guns was made in July, 1941; work began August 1, just two weeks after the last car or truck rolled off the assembly line. Almost exactly six months later, the first gun carriage was produced.

It used to take almost half this time to retool this plant for the relatively simple annual change to new motor-car styles. This time, the plant had to be remodelled. All the tools and fixtures of car production had to be removed. The purchase and installation of 348 machine tools had to be undertaken, and that at a time when machine shortages had come to be seriously felt. But machine tools were the prime necessity, because 3,000 separate machine operations are required in making gun carriages. And so, the equipping of the factory was pressed forward. Largest tools required were the 36-inch Bullard universal vertical turret boring mills, each costing many thousands of dollars.

Engineering ingenuity played its part in this conversion. The technicians of General Motors, because of their past experience with line conveyors, felt that such a system could be redesigned and adapted successfully to gun carriage mass

production. Results have more than justified them in this belief. This is the only gun carriage plant in Canada using the line conveyor system of assembly.

Precision Technique

Application of the mass production-precision technique to unfamiliar fields is illustrated by the assignment received in 1941 by General Motors of Canada, Limited to make machine guns. Few men employed by the company had ever even handled such a weapon. None knew the gunsmith's craft, but engineers and production men were familiar with the manufacture of precision parts on a large scale. So they pooled their knowledge and the result was a new factory, Border Cities Industries Limited — designed to handle raw materials, machining and assembly in the most efficient manner for production of the gun wanted. General Motors agreed to direct the production, and the present output of Browning machine guns — calibre and performance a Government secret — is a tribute to the "know-how" of an industry which the public associates only with peace-time products. Secrecy was imposed while the big factory was coming into production, but it is now revealed that 1,000 employees, principally girls specially trained on precision machinery, are turning out "one of the most destructive weapons in the armament programme of the United Nations".

Precision is the key-note in the manufacture of these guns, and there are some 1,800 separate machine operations on the parts, which number approximately 150. A high production schedule has been set.

Working Conditions

The like of this plant has not been seen in the district before. A cafeteria seating 825 operates in connection with it. Rest rooms, first-aid quarters, medical attention, and airy, bright surroundings make the plant as comfortable and free from the usual grime and gloom of a factory as is possible to imagine.

Employees work ten-hour shifts, with half an hour for lunch and two short rest periods each day. During the rest periods food may be purchased at the cafeteria. The fully equipped modern kitchen with a

chef and kitchen staff equal to that of a city hotel care for their needs.

The girls seem intensely interested in their work and proud of their contribution to the war effort. They express complete satisfaction with working conditions and wages.

One of the most interesting rooms in the plant is the air-conditioned "standards room". Here are a score or more of the most precise measuring devices that it is possible to obtain, including the highly accurate Johansson gauges and the shadow graph. One measuring machine reveals degrees of distance to a millionth of an inch. In this department, all the gauges used by inspectors are tested and trued up before using.

The plant has approximately \$7,000,000 worth of machinery and the structure itself cost roughly another \$1,000,000.

Spectacular Economies

Now for examples of the cost-cutting process, which is a component of the automobile industry's best technique. Conversion of the industry to production of war materials has resulted in some spectacular economies in time, labour and materials, both as regards the volume of skilled labour usually required, substitutions for critical materials and simplification and speeding up of manufacturing processes and modifications in design.

An outstanding example of the application of technique to economy is to be found in the development of a project for the manufacture of a gun mount at General Motors of Canada, Oshawa. Engineers from Oshawa first of all visited motor-car factories in the United States, where similar mounts were being produced. In the process of tooling for production of the item at Oshawa, it was felt that a considerable amount of critical material could be saved by making the mount of structural steel instead of the cast steel which had hitherto been used.

Technicians then proceeded to build an initial structural steel mount; British authorities examined this new product, and, being more than pleased with the result, authorized production; consequently there has been a considerable saving in the cost of material over the cast steel base. This

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costs approximately \$504, whereas the new type structural steel stand costs only \$275, which represents a saving of approximately \$229, and, at the same time, of approximately 600 pounds of critical steel. On the basis of initial order, this involves a saving of \$68,700 or 180,000 pounds of critical steel.

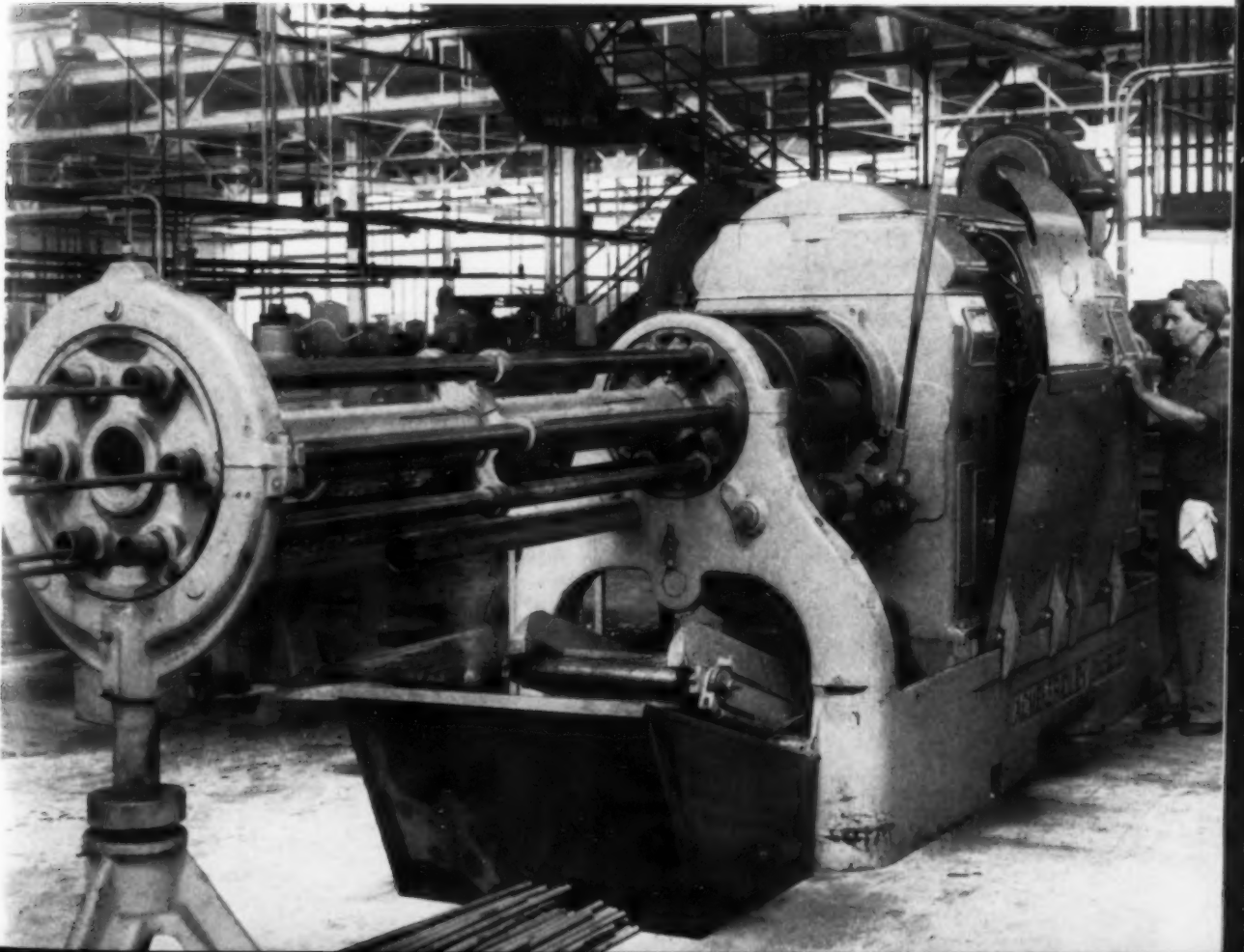
In addition, there is also a saving of \$38,000 covering the cost of two large engine lathes, which were cancelled due to the new type structural steel stand. The combined saving amounts to \$106,700.

It might be pointed out that the material in the original cast steel stand is five or six times more expensive than the steel which is used in the new type stand. Another favourable point is that the scrap factor on steel cast stands is much higher than for the new designed stand. For example, a machine operator, due to poor

workmanship in the machining, could quite easily damage a complete cast steel stand. Or, on the other hand, a casting might be discovered to be defective in the machining operation, and have to be completely scrapped. On the new type stand, this would not happen, as there would always be a large percentage of the stand which could be salvaged. A further saving is in structural steel, due to the fact that it will not be necessary to have monorails, etc., to take care of the heavy cast steel base.

Another apt example of cost cutting and material saving is mass production of fuses at The McKinnon Industries Limited, a subsidiary of General Motors, where substitution for critical metals, simplified procedure, streamlined inspection, and reduction of essential machining have cut the cost of fuse manufacture by almost two-thirds.

Border Cities Industries (General Motors) — big machines are operated by girls in the manufacture of the Browning machine gun.





Operations on machine guns include some so minute that they have to be performed with the aid of a glass (Border Cities Industries).

Originally, these fuses were machined out of bar brass, a critical metal. The process was costly and more than half of the brass for each unit was machined off and returned as scrap. To-day, the fuses are being made of a zinc alloy, by a die-casting method which is fast and accurate and which involves only a fraction of the machining required by brass fuse bodies. A comparison of metallic weights and costs is illuminating, although the substantial saving achieved here is only a fraction of the total savings effected by other improvements analogous to the modified procedure. The result of this substitution has been the saving of 3,633,800 pounds per month of a critical metal, brass. In its place, only 1,042,500 pounds of a much less critical metal, zinc, is used. The cost of fuses to our government has now been reduced by approximately 70 per cent.

The alloy employed in the die-casting method is 95 per cent zinc with fractional

percentages of alloyed aluminum and copper. The fuse body is cast to size on the majority of its dimensions. The only locations machined are threads and undercuts which cannot be cast because the core must be withdrawn. There are a few qualifying operations where depths of holes and finishes are critical and a very slight cut is skinned off; but the amount of stock removed in those operations is being steadily reduced as experience narrows the margin of accuracy the die-casting method permits. The high volume of production has afforded an opportunity for rather extensive research on even the most minor operations because, characteristically of the automotive industry, saving even a fraction of a cent is considered in terms of total economy in relation to production of millions of a given item.

Minute and Exhaustive Inspection

Inspection during production of any article which is to contain explosives is

Another machine-gun-builder. This girl is one of many who operate machines ordinarily associated with men mechanics.



necessarily minute and exhaustive. Burrs, ragged edges or rough surfaces present hazards to the insertion of explosives and must be eliminated, without exception. They would also be a hazard against obtaining positive detonation at the high temperatures necessary to ignite the larger charges of explosive in the shell to which the fuse is applied. And for these same reasons, dimensions must be held to precision to ensure the explosives fitting accurately in their components.

Minute inspection is costly in terms of time, but the application of mass production technique is steadily reducing this cost factor. This has been accomplished by using motion study together with scientific combinations of gauges to make it easy for inspectors to perform rapid, accurate inspection. In one instance, that of the die-cast magazine body, as many as 57 dimensions with tolerances to several thousandths of an inch are measured in 50 seconds.

These improved methods of inspection are applied as generally as possible. Thus, while the original inspection of fuse bodies required eight inspectors using loose hand gauges, to-day these gauges are mounted in order in front of one operator who checks each dimension in proper sequence — a net time-saving of over thirty thousand hours per month. This streamlined inspection method, applied to fuse magazines, requires only two operators to inspect 600 pieces per hour, while the previous method allowed only 115 pieces per hour — a time-saving amounting to almost four thousand hours per month.

Besides the magazine and body, the bottom cap for the fuse is die cast. The thread in the cap is so accurately cast that only one machining operation to remove the flash from the casting, and at the same time face the piece to length, is required.

The three die-cast parts comprise the bulk of the metal used. Other parts, such as pellets, springs, centrifugal bolts, plugs,



Girls operating a special machine for drilling three holes in brass fuse shutter. This machine was designed and built in the General Motors tool room, and is so arranged that all three holes are drilled simultaneously.

swivel detents, striker pins, and detonator holders are mass produced in almost finished condition on automatic machinery. An interesting sidelight is the making of the shutter detent out of spring brass on an automatic punch. A special machine turns them out with extreme rapidity, and, as a helpful afterthought, chops the brass into convenient bits so that the scrap can be bagged rather than rolled.

The twenty odd components meet on a moving assembly line, where the labour or handiwork factors have been reduced to such simple increments as to permit training a new operator in twenty minutes to attain a speed of 700 pieces per hour. Government inspectors, at intervals along this line, check and mark the fuses; and

at the end of the line they are packaged for shipment to the loading point.

"Bottlenecks" Eliminated

Facility with machine tools and the ability to rebuild tools is another field in which the automotive industry has eliminated costs and "bottlenecks" in the assignments which have been given to it in the war programme. The job of building tanks was a challenge which brought out the best in engineering ability. By rebuilding a multiple-type machine tool for a tank job, one firm released six additional machines for another war assignment. A second company (in the United States) developed several mammoth jigs to hold plates and sub-assemblies in place, prior to final assembly of a tank hull. Taking

Right:—Final assembly line, on which fuses are being completely assembled by means of a travelling conveyor. Two of these conveyors are in operation, each assembling completely 750 fuses per hour. Also on this conveyor line the fuses are wrapped in wax paper and packed in a box ready for shipment.





Finished die-cast fuse bodies coming off the end of a conveyor line. On the same conveyor, magazine assemblies are being handled. These girl operators are visually inspecting both of these parts, which are completely machined at this point, and are placing them in suitable racks for delivery to the final assembly line.

their cue from such examples, when the company received an order for hulls for a new-type tank, General Motors of Canada engineers designed their own huge jigs for lower tank hulls. Weighing 10 to 15 tons (almost as much as a tank itself), these jigs are equipped with a cradle-like framework that permits them to revolve barrel-wise or to any other position needed for down-hand welding.

Because General Motors of Canada was equipped with highly-developed tool-rooms, the company was in an advantageous position in respect to its own war assignment and was also able to step into emergencies caused by the fact that other industrial concerns in Canada were not so well equipped. For instance, tools and fixtures from the General Motors tool-rooms at Oshawa were supplied for the manufacture

of carriages for the essential 3.7 anti-aircraft gun. Tools and fixtures for handling mounts for a naval gun were supplied to a Montreal firm. Considerable die-sinking was also done for the Aluminum Company of Canada.

Contributing Industries

Back in peace-time, the automotive industry used to refer to its "contributing industries". These were the hundreds upon hundreds of suppliers who made the component parts of motor-car assemblies. Some of them are now making the component parts of war-product assemblies. Additional hundreds have been added to the list. The ability to use the skills of these hundreds of small sources is a distinct advantage in the huge task of all-out war production, and the motor-car industry pos-

THE MOTOR CAR INDUSTRY MAKES VICTORY ITS BUSINESS

sesses that ability to an important degree. In Ottawa's programme, which calls for the spreading of capacity even unto the farthest and smallest limits, this has been a very material advantage.

"Dividends"

These, then, are the components of the "secret weapon". They may be regarded as typical of what the automotive industry — and other industries — are doing in the big war industry programme which will never be fully reported until the fighting is over and peace is won. They are the "dividends" which the Government of Canada and the people of Canada are collecting from the automotive industry's investment over the years in engineering and in production "know-how". As time goes on, there will be many more examples as engineers and production men of industry become more and more familiar with the essential products they have been

called upon to build for Canada's all-out effort.

It will be seen that the automotive industry is doing its job in the three critical fields of war endeavour: materials, machine tools, and manpower. Manpower, a subject in itself, is inextricably wrapped up with experience and technical knowledge, and will always be available in necessary volume for the industry which has proved itself worthy of priority when priorities become necessary.

In the inevitable examination which must be made of Canada's future, the general conclusion is that the Dominion will need every peace-time industry to provide employment. Technical management will once again be the key to the problem as it has been in the war-time dilemma. Management has proved conclusively that it is worthy of the public trust in the worst emergency that can be conceived, and management will once more get the call.

Service is extended by General Motors to the scene of action. Hundreds of soldiers are trained in servicing vehicles and other General Motors products. A typical class at Oshawa.





Here's one reason why telephone circuits are precious these days. A machine gun in action for four minutes shoots away as much copper as a mile and a half of telephone wire. Telephone channels should be kept for vital war messages.

THERE is a cartoon showing an American soldier carrying a "walkie-talkie", or portable radio-telephone, and saying to a comrade, "I want to make this clear right now. I am not to be used for personal calls."

In the Battle of Egypt, tank commanders deliver all orders, even to the man sitting shoulder to shoulder with them, by telephone. Noise would distort and drown the loudest shout.

Over their field radios, British officers could hear the voice of Field Marshal Erwin Rommel himself, radioing orders across miles of desert to his front-line tanks.

In the fierce air-fighting over Malta, a voice says casually in a fighter-pilot's earphones, "Say, Buzz, there's a Jerry diving on your tail".

Even communication between members of the crew of the same bomber has to be carried on by telephone.

War on thousand-mile fronts, war at 300 miles an hour is conducted as personally as an old-time cavalry charge because of the miracle of modern communication.

The invasion of Poland was announced to President Roosevelt in Washington by Ambassador Bullitt in Paris over the transatlantic radio-telephone.

In the days of American neutrality, "Franklin" talked to, and became acquainted with "Winston" by telephone.

Arrangements for interning German prisoners of war in Canada were reached by this means.

MR. BELL MASTERMINDS THE WAR

Communications Put the "United" in United Nations

A man in Washington replaces his receiver and says to a visitor, "Excuse me a moment. That was General MacArthur in Australia. He wants six orthopedic surgeons at once. I must make arrangements for them to fly to San Francisco to-morrow."

Churchill asks, "What do you think about this?" And from the far corners of the earth, answers pour in with incredible speed.

Global war, war around the clock, is carried on as easily as a chess game because of the speed and scope of telephone service.

On a lonely hill-top near the Nova Scotia coast, a chilly civilian watcher jumps suddenly to a telephone. "Aircraft detection flash!" he says. "Two planes. Bimotor. Strange markings. Bound in. Medium altitude. Overhead."

From these cryptic words, echoed by successive watchers, experts plot the course of the strangers and make plans to intercept these invaders of Canada's defences.

In a quiet Toronto home is heard the jingle of a telephone. From an east coast Canadian port Sonny is calling to tell Mom that he was among the survivors of a convoy reported to have been attacked by submarines.

From and to Ottawa, from the far-flung war plants of the Dominion, come a host of telephone calls. For every one of a certain type of fighter plane that rolls off the assembly line, 450 local and 15 long distance calls are made. It may take 12,000 calls, local and long distance, to make one bomber, 50,000 to build one corvette.

From a lonely post on the new Alaska Highway, a United States Army engineer makes known his needs to supply departments in Washington, New York, Chicago.

Over the slender threads of copper that make up the Trans-Canada Telephone System, a ship-builder in Vancouver calls to Ottawa for more of that same precious red-gold metal. A 10,000-ton merchant vessel requires as much copper as a telephone circuit nearly 600 miles long.

Even in peaceful Canada, war is on the wires! The metal that goes into those wires is also on active service.

Canadian telephone users are cutting down on telephone calls to clear the lines for these essential messages.

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As one of its major activities in carrying out its purpose, the Society publishes a monthly magazine, the Canadian Geographical Journal, which is devoted to every phase of geography—historical, physical and economic—first of Canada, then of the British Empire and of the other parts of the world in which Canada has special interest. It is the intention to publish articles in this magazine that will be popular in character, easily read, well illustrated and educational to the young, as well as informative to the adult.

The Canadian Geographical Journal will be sent to each member of the Society in good standing. Membership in the Society is open to any one interested in geographical matters. The annual fee for membership is three dollars in Canada.

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Hurricanes by IVAN RAY TANNEHILL, Chief of Marine Division, U. S. Weather Bureau. Princeton University Press, 1942 \$4.75.

In this book, Mr. Tannehill displays a happy faculty of expressing his own wide knowledge of his subject in popular terms. His book is admirably arranged, and the text is simple and concise, with a bare minimum of professional phraseology. He deals, in a complete but non-technical form, with the revolving winds of hurricanes and accompanying tidal waves and excessive rainfall, together with their associated phenomena of high wind velocities and extremely low barometric pressure. His attention is, naturally, more particularly directed toward hurricanes affecting the United States and West Indies, and he traces the origin and plots the tracks of the main storms affecting these areas in historic times. He also appends a record of 978 tropical storms that have visited North America in the 450 years since the first voyage of Columbus. Chapters on the destructive effects of hurricanes, the measures taken for their prediction, and precautions that may be taken to avoid damage and loss of life are particularly valuable. The book is copiously illustrated with maps, diagrams and photographs, and a comprehensive bibliography is included.

In Canada we are, in general, not seriously affected by these tropical storms most of which are, happily, deflected from our shores to spend their main fury in the open seas. We have, however, enough records of storm damage in our history — from the Saxby Gale in 1869, to the storm of last September that tied up traffic in Nova Scotia for several days — to make this book of direct interest to Canadian readers, to whom it is heartily recommended.

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Compendium and Description of the West Indies by ANTONIO VAZQUEZ DE ESPINOSA. Translated by Charles Upson Clark. Published by the Smithsonian Institution, Washington, D.C., 1942.

This book is a translation of an unpublished manuscript in the library of the Vatican, written between 1620 and 1630, and attributed to Fray Antonio Vazquez de Espinosa — a Carmelite friar and missionary to the Indies. The translation, editing and publication were carried out under the auspices of the Smithsonian Institute.

The author in his manuscript endeavours to give a complete account of the Spanish possessions in the Americas and Philippines, including a description of each section of the country — its settlements, products and industries. From internal evidence it is obvious that much of the information was obtained at first hand, and we are able to follow the wide range of his travels from Mexico to Chile. In addition, he includes summaries of the histories of the Mexican and Inca Empires and notes on many tribes and languages. His description of mining in those days is of particular interest. The first part of the book is devoted to a naive attempt to prove that the inhabitants of the Americas are descendants of the lost ten tribes of Israel. It is interesting to note, however, that his theory that the Americas were first populated from Asia, is that which is now commonly accepted by anthropologists.

Fray Vazquez shows himself a keen observer, and a man of courage, insight, and sensibility, who is not afraid to attack abuses. His zeal for the propagation of Christianity, however, blinded him to the cruelties of the Inquisition, and he touches only lightly on the terrible extermination of the helpless and docile native population of the West Indies, and the general exploitation of the Indians throughout the Spanish Dominion. The translator, Charles Upson Clark, is to be highly complimented on his success in retaining in the translation so much of the characteristics of the author and of his times.

To the general reader this book is chiefly notable for showing the great extent of the Spanish penetration of Central and South America at that early date. The manuscript was written only about 130 years after the first voyage of Columbus, and in that relatively short space of time Spain had planted colonies from Florida to Patagonia and had overthrown by arms two great empires and subdued innumerable savage tribes. These colonies were no flimsy affairs of tin and tar paper, but included great and wealthy cities, ornate with beautiful churches and public buildings — many of which stand to this day. Spanish colonial policy was deeply rooted in the development of the land, and the Spanish culture, language, and way of life still continue, strong and vigorous, throughout these vast areas, after more than four centuries. This is perhaps the most amazing record of conquest and colonial expansion in all history: a record in part, of brutality and greed, of the spread of Christianity, but, above all, it is the saga of the indomitable courage of the conquistadores, who faced armies with platoons, and subjugated and retained empires with only a handful of men, cut off from all support and dependent only on their own stout hearts and swords.

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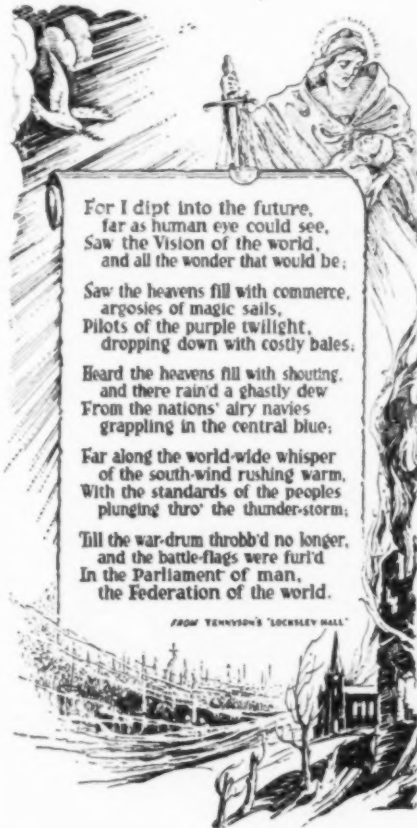


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